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STEAM POLLUTION FROM INDUSTRIAL SOURCES. (FUTURE REQUIREMENTS AFFECTING INDUSTRIAL EFFLUENTS)

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STREAM POLLUTION FROM INDUSTRIAL SOURCES *

(Future Requirements Affecting Industrial Effluents)

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The title of my discussion today is perhaps somewhat misleading. You are interested, I am sure, in how the future may affect the requirements for industrial waste effluents. I have no special qualifications for forecasting future events, particularly with respect to the details of so complex and diverse a subject as water pollution control practice. Examination, however, of some recent trends may be of interest.

Pollution of waters has been of concern to man for many centuries - probably since he first congregated in fixed communities. Hippocrates is credited with prescribing boiling or the filtration of polluted water to render it safe to drink. Water pollution has been of serious concern to our English speaking civilization for well over a hundred years. The report of the Sanitary Commission of Massachusetts in 1850 concerns itself in part with this subject and, a series of Royal Commissions in England which gave detailed attention to the pollution of rivers and streams, stated them to be "of immense public concern".

The legal aspects of the control of water pollution appear to be derived basically from the common law. The principle of protection of downstream water users or riparian owners against hardship or loss caused by unreasonable degradation of water quality is firmly established by numerous

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court decisions. Relief in this manner comes only after the injury has occurred and the desirability of legal and administrative powers for the prevention of damage and regulation of pollution seems obvious.

Many definitions of pollution have been advanced. Kittrell's [1] definition, although perhaps oversimplified, may be taken as representative of current concepts; he states that a pollutant may be considered to be any substance present in water at the point of use in concentration sufficient to interfere with such use. Pollution, then, is basically a characteristic of the concentration and any substance if diluted adequately may be considered non-polluting.

In the United States, until recently, major attention in the field of water pollution control has been focused upon the problem of sewage pollution, initially because of the relation to water-borne enteric disease and later because of the effects of organic loadings on streams and aquatic life. Although good control over the incidence of water-borne enteric diseases has been achieved, the growth of American urban populations and sewer systems has been such that the overall magnitude of sewage pollution has continued to increase in spite of the growing number of municipal treatment installations. Furthermore, as the American economy has become increasingly industrialized, the contribution to our streams of water-borne industrial wastes has grown to increasing importance. Specific figures of the national totals of industrial waste discharges and their pollutional effects are not available, but it is known [2] that the total organic

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(1) A Rational Approach to Stream Pollution. F. W. Kittrell, Civil Engineering, 15, 69 (1945).

(2) Water Pollution in the United States. Public Health Service Publication No. 64, 1951.

pollution load in the nation's waters exceeds that which would be contributed by the raw sewage from 150,000,000 people and that the major portion of the existing pollution is derived from industrial wastes. Reliable estimates indicate that the potential pollutional contribution by industrial wastes may be expected to increase both on an absolute basis and as a percentage of the total. Industrial production in the United States has more than doubled in the last 20 years (3) and the President's Materials Policy Commission (4) estimates expansion of raw materials use by 53 per cent above present levels by 1975. Other indications of the probable increase of potential pollution contribution may be obtained from estimates of water requirements.(5) Municipal water usage currently is estimated at 13.5 billion gallons per day and is expected to increase 50 per cent by 1975. In the same period, it is estimated that industrial water usage, on the other hand, will increase 170 per cent above the current consumption of 80 billion gallons per day (50 b.g.d. for steam power generation and manufacture of steel and allied products).

Authority for control of water pollution has rested primarily with the States. The Federal government, through the Congress, has asserted only the limited authority of the Acts of 1899 and 1914, and the Water Pollution Control Act of 1948. These acts limit Federal legal jurisdiction to discharges depositing solid material in navigable waters, oil discharges in coastal waters, and interstate pollution problems under carefully described circumstances. Indeed, the Congress has been explicit in declaring

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(3) Federal Reserve Board Index of Industrial Production.

(4) Resources for Freedom. President's Materials Policy Commission, 1952.

(5) Chemical and Engineering News, 30, 44, 4596 (November 3, 1952).

the Federal policy to recognize, preserve and protect the primary responsibility of the States in controlling water pollution.

During the last decade, and particularly since the end of World War II, there has been much public interest in water pollution control and activity in the expansion and redefinition of the activities of State governments in this field. No less than 18 States have new or extensively amended laws which have been enacted to control water pollution since 1945. In addition, in the same period, interstate compacts regulating the pollution of interstate streams have been ratified in the New England and Ohio River areas. Also in the same period, the International Joint Commission, established by treaty between the United States and Canada, evidenced renewed interest in the pollution of the boundary waters between the two countries. Some examination of the authority and activities undertaken under the new legislative enactments may be of interest.

The general thesis with which both technical and legal authorities have appeared to agree, is that potentially polluting substances should not be permitted to interfere with water uses important to the area. As thus stated, the general thesis may appear simple but it is subject to many technical uncertainties and subjective interpretation by administrators.

Some discussion of terminology may be apropos at this point. In connection with water quality, a number of terms are of recurrent usage in the legislation and regulations. These include "stream classification", "objectives", "criteria", and "standards", which have not always been delineated.

In general, "objectives", where used, appear intended to denote the

goals of program administration. "Standards" have had a connotation of legal requirement, either by direct legislation or regulation. "Criteria" denote a method of measurement or means of forming a judgment. "Stream classification" has related to the zoning of stretches of streams to accord with the water uses being made or anticipated in such areas. All of these terms are important because they are related closely to the philosophy and flexibility of administration of the individual laws.

In only one State has the announcement of "objectives" of water quality been put to use as an administrative device - namely, Ohio. In this instance, they apparently are to be construed as criteria on which judgment may be based in determining the quality of effluent discharges in individual cases. This is quite similar to the practice recently followed by the International Joint Commission in which the announcement of water quality "objectives" was supplemented by tentative specific water quality "standards" and probable effluent requirements (in limited areas) which would be associated with them.

Of the 18 States having recently enacted legislation, eleven make use of specific stream "classifications" by the zoning device. Commonly, the establishment of classification is by regulation, although in one or two instances (New Hampshire) (South Dakota), the classification scheme has been incorporated in the basic law. Almost universally the classification scheme is accompanied by "standards" of water quality, spelled out in varying degree of detail, applying to the various zones. The New York State Water Pollution Control Board has probably what is the most complete and complex classification scheme, with accompanying "standards", which divides the State's inland, shore and ground waters into 13 categories.

By far, the greatest number of references to "standards" in the newer legislation of the individual states and the regulations based thereon pertains to the quality of water in streams or other bodies of water receiving the wastes. In only a few instances do such "standards" pertain to effluents discharged by municipalities or industries. Among the States, Pennsylvania has apparently made the most extensive application of effluent standards. This has been done in connection with the classification of all the streams in the State into three categories: (1) those for which organic waste discharges must be given complete treatment to achieve 85 per cent B.O.D. removal, (2) those for which effluents must be given primary treatment, and (3) acid streams for which no treatment of wastes is currently required. In addition, the State has promulgated effluent standards for a variety of industrial wastes, developed in cooperation with committees representing the specific industries. A unique feature of these industrial waste effluent standards comes from their derivation from the establishment of so-called "normal" waste strengths; in this way the more efficient process operator is favoredand the less efficient handicapped.

In the four years of its operation, the Ohio River Valley Water Sanitation Commission has used a variety of the usual administrative devices. The compact agreement itself specifies a minimum degree of treatment of sewage discharged to the Ohio River and certain of its tributaries. The Commission has adopted water quality "objectives" for bacterial content of waters to be used as water supply sources or for recreational purposes. The main approach of the Commission, however, has appeared to be by study of individual cases or areas and the subsequent promulgation, after public hearing, of effluent standards designed in each case to prevent injury to the

various water uses affected.

Recent legislation in 6 States appears to provide generally for the "case by case" administration of water pollution control problems. A general feature which is common in these is the absence of official water quality "standards" although in some instances the legislation permits their adoption. Generally, it appears the intent that administrative decision be guided in individual cases by the general legislative objectives and available technical criteria of water quality. The outstanding example of this approach among the States is probably provided by California. There the law specifically provides for the "case by case" handling of pollution problems by the several regional boards with decisions based on water use and overall broad economic and other considerations. For the advice of the regional boards, the State Board has undertaken the compilation and analysis of available technical and legal data pertaining to water quality "criteria" for various water uses.

A few general remarks about the "standards", "objectives", and "criteria" in use may be appropriate. Numerous authors have pointed out disadvantages of general application of effluent standards, the most important being the lack of correlation with actual stream conditions and needs for various water uses, under-correction being attained perhaps in some cases and over-correction in others. Current practice by regulatory agencies seems to reflect this attitude. While certain effluent standards pertaining to floating and sludge depositing materials are fairly widely used, the use of effluent standards has been restricted largely to application in complex, metropolitan areas where review of the effects of individual discharges has been impossible as a practical procedure. Thus, the Interstate Sanitation Commission, the Interstate Commission on the Delaware River, the International

Joint Commission, and the Ohio River Valley Water Sanitation Commission have all made use of effluent standards relating to discharges in various metropolitan areas with which they are concerned. In all of these cases, however, the effluent standards as applied have been made subsidiary to the "objectives" of water quality for the current or anticipated water uses in the respective areas. In these cases, the use of effluent standards apparently has had much in its favor as an administrative device to simplify procedure.

With respect to the so-called "standards" of water quality adopted or promulgated by many of the States, the rigidity implied by the term "standards" is perhaps more apparent than real, particularly with respect to many industrial waste discharges. It is common to find "standards" relating to bacterial contamination, floating solids, settleable solids, oil, pH, etc. All "standards" with which I am acquainted contain provisions relating to dissolved oxygen and, in some cases, to B.O.D. These, however, can be regarded as more in the nature of "objectives" since they refer to an indirect effect of waste discharge and are included mainly because of the importance to aquatic life. The practice with respect to "standards" applying to phenolic and other taste-producing compounds appears to vary, being rather rigidly established by some authorities and more flexibly by others. With respect to the large numbers of substances included in such terms as "toxic wastes", "dissolved minerals", "deleterious substances", "colored wastes", "heated liquids", "tars", etc. - general statements only are usually included. These may be regarded in effect as "objectives". The New York State standards, for instance, include a series of statements which say, in effect, that such classes of materials shall not be present in amounts sufficient to interfere with the water uses for which the various classifications of the waters are intended.

That flexibility in the administrative application of water pollution control is one of its prominent characteristics, is illustrated by the foregoing. The necessity for such flexibility should be apparent in view of the complexities of aquatic biology, the reactions involving pollutional materials, the variations in dilution water available and the subjective judgments involved in making decisions involving the equities of various water uses. Insofar as ground-rules may be made setting forth the general considerations involved in the administration of water pollution control, however, the establishment of the program "objectives", "standards", and "criteria", serve a very useful purpose.

There are two additional compelling reasons for the maintenance of considerable flexibility in the administration of water pollution control: (1) the current imperfection of knowledge regarding many technical aspects of pollution problems, particularly as related to industrial wastes, and (2) the dynamic and changing nature of American society. An outstanding characteristic of the United States has been its rapid economic growth with accompanying technological advancement and complexity of industrial operations. The national economy has compounded in recent years at a growth rate of approximately 3-1/2 per cent, thus doubling the national production in about each 25 years. Many segments of industry of importance from a water pollution standpoint, however, are growing at a considerably faster rate - the chemical industry, for instance, has been growing about four times as fast as the average of all industry. The estimates of the President's Materials Policy Commission give indication of the continuation of these trends in the next 25 years. Inevitably, the quantities of industrial wastes to be disposed of will increase correspondingly.

The gaps in our current technical knowledge relating to the control of industrial wastes pollution are often painfully obvious to both control agencies and individual industries. For instance, aside from the ignorance of economical methods for satisfactorily reducing the pollutional effects of certain wastes, we lack even suitable analytical procedures for gaging the presence of some important polluting substances and effects. We know little about the rate of biological metabolism of many polluting substances, and in the absence of such knowledge are not in position to take advantage fully of the self purification which occurs in the receiving waters. The extent of ignorance concerning toxic factors to aquatic life and to humans is of increasing concern to technical people in the field, and there is some evidence of developing public concern.

Who, then, is to assume the responsibility for developing the requisite knowledge for handling these problems satisfactorily? There is, in my opinion, only one reasonable answer. Industry has had the initiative and technological competence to create the amazing record of the American economy. It similarly has the technical competence and is best equipped otherwise to solve these problems of waste disposal. From the standpoint of our overall economy and the efficiency of our American civilization, it is best that the job be done largely by industry. To our credit, many industrial associations and individual concerns are devoting increasing attention to this field. The announced policies of such firms as General Motors and DuPont that waste disposal problems must be solved in connection with the production of new products or the establishment of new plants, is evidence of their progressive thinking and social conscience.